Language and Programming for Computer Input, Filing, Retrieval and Communication

Homer R. Warner, M.D., Ph.D.
Professor and Department Chairman
Department of Biophysics and Bioengineering
Latter-Day Saints Hospital
Salt Lake City, Utah

After being led out of the wilderness by Doctor Barnett I feel almost sacrilegious to tell you a story about a drunk. This fellow was out on a dark snowy night looking around under a light on the corner and a policeman came up to him and said, "What are you looking for?" He said, "I've lost my wallet." So he began helping him. Soon a crowd gathered around and they were all looking around for the wallet and after the snow had all been trampled down and clearly the wallet wasn't around, the policeman asked him, "Are you sure you lost it here?" He said, "No, I didn't lose it here." He said, "Well, why are you looking here?" He said, "Well this is the only place there is any light."

Now this is the situation we find ourselves in when we tackle any scientific undertaking. We have to use the tools that are available to us and those tools are not always just the machinery but also the intellectual tools that are available to us. Many people early in the game thought that the tools are already there, that somehow through the magic of engineering we could just ask the engineers who solve problems in other areas to come in and solve our problems, and it would be a 1 to 1 application of techniques that were already there. We have been disillusioned in this area. Perhaps we should have predicted this. Just as the tools from information theory have proven of almost no use in understanding central nervous system performance, the tools from engineering are not any panacea for the ills of medicine that we are trying to tackle with computer methods.

I would like to get on with some specific comments about the material presented this morning. First Doctor Pratt described for us a system using a SNOP nomenclature which is the sophisticated approach to doing a total job of recognizing text and interpreting it in terms eventually represented in the machine as a set of codes that can be further processed for other purposes. We have been using SNOP too for a couple of years to do much the same kind of job both in pathology coding and in clinical coding, only we have taken a little different approach than Doctor Pratt described. We have taken the approach that we first want to facilitate the interface between the human and the machine, and since people in general, particularly doctors, take poorly to typewriters and it is the

doctors that we want to do the coding, we thought we ought to make that typewriter look as innocuous as possible. So we developed a system around a scope display with a standard keyboard at which the physician sits with the medical record in front of him and he begins typing a word from the diagnosis. After he has typed in the first two letters the computer begins an alphabetic search to find the number of terms beginning with those two letters. If more terms appear that begin with those two letters than can be presented on the face of the display, the computer waits for the third letter. Otherwise it will display immediately that list to him before he hits the third key. He then from that list begins a branching decision-making process down the SNOP coding, which is beautifully constructed for this kind of approach, until he describes as much detail about that particular one of the four fields (topography, morphology, etiology and function) as he wishes to put in.

We found that the nomenclature used to describe the four fields is confusing to physicians. They really don't know what we mean by topography and morphology. Etiology and function are a little clearer although even some things classified as etiology are not really etiology to the physician, so we have simply bypassed that. He doesn't have to first enter which of the four fields he is dealing with. The computer will decide that for him. But he is forced to enter, or at least specify explicitly, that he has no entry for one of those fields if that is the case. For instance, if he wants to describe a patient with myocardial infarction he might start with heart, or ventricle, or infarction. Let us say he describes heart and it takes him down through ventricle in as much detail as he is able to give, it then will come back and ask him for the other three fields. So that not only does this on-line mode of interaction provide a tutorial element to the whole sequence of forcing him to think in terms of -- "Do I have information regarding these essential parts of the diagnostic code?" -- it also provides another thing that Doctor Pratt alluded to in his presentation and that is the error checking. Any sort of on-line entry allows the computer to behave in this fashion. Spelling errors are impossible with this. If he makes a mistake in those first two letters he gets a list that is completely irrelevant to what he wanted to enter in the first place and he can start over. But it is impossible for him to make a spelling error and get it into the system. We had hopes that the physicians would take to this and we could bypass the medical record technician who normally does the coding, but as a matter of fact, the closest we have come to getting the physicians to do this so far is the use of medical students.

We hired two medical students who alternate nights coming in and coding in the records for that day's discharges. We still hope we will get the doctors to do this and I would like to reemphasize a point that Doctor Barnett made that you really

cannot expect to optimize the contribution that computers can make to the system without some change in the habits of the people involved. We haven't really made the maximum effort and really aren't in the position to make the maximum effort to control the physician's activities to the point of getting him to make that entry yet.

We have done some other things to SNOP in order to make it applicable to clinical codes. Actually we have had to add relatively few codes. Most of the additions have been in the form of synonyms so the doctor can enter several different words and get to the same point in the entry routine. I asked John Morgan, the graduate student who has done this project, how many additional terms we had entered to make this a practical tool for everyday clinical coding and he said less than 50 new terms have been added. However, we have added one completely new field, so we deal with five fields instead of four. We have added a therapy field which includes all the surgical codes and some additional codes concerning treatment. We have also added shortcuts with the computer. There are very easy ways to get information in. If the man first identifies himself as an obstetrician, immediately he is presented with the common entries that obstetricians make and by this one button press he can make an entry about a normal birth, a normal newborn baby, things like this.

I would like to talk a little about some material that was alluded to yesterday, that is, which part of the health care system we start on and where we can have our greatest impact with computers. Once again this isn't so much an analysis of where we will have the greatest impact but each of us has to evaluate where we can make the great impact. In our operation we have started with the sickest people rather than the well people, and we for five or six years now have been heavily involved with intensive care. Our system consists of two computers with the same kind of backup and we are in conformance with Law #4 - duplication of the system - I can certainly verify that this is an important part of the operation.

In starting with this we have attempted to do several things. First of all, we wanted to try to make some measurements and provide some kinds of data that would not be available without the machine. In order to do that we have introduced catheters into these patients before they go to surgery. Or, in the case of patients with myocardial infarction, as soon as they come on the ward a tiny catheter is introduced by a technician into the radial artery and advanced up into the subclavian and we then monitor this during the patient's stay in the intensive care ward. From that central arterial pressure wave form we can derive information such as the cardiac output, the stroke volume, the peripheral resistance, the duration of systole. Recently we have been looking at other variables the clinician

uses such as the presence of pulses alternans which can be defined in the computer in a much more objective fashion than by feeling with fingertips. We are looking at arrhythmias, analyzing these automatically, and reporting back to the physician when a change in rhythm occurs.

Now the reporting system really involves a filtering mechanism. Early in the game we thought that the approach would be to use a statistical method to separate the data that represents a significant change in the patient's status from the data that represents no change and thus need not be brought to the attention of the physician. But we learned that the statistical methods really were not the answer to the problem at all. In fact the only kind of filtering that is meaningful, in my opinion, is the filtering that eliminates all but the information essential for making a decision. And unless information is of that type you just as well not bring it to the attention of the physician or nurse because all you do is frustrate them. Obviously you can't present them with all the data and it is even true that you can't present them with part of the data even though it may represent a statistical change or even a physiological change unless you give them some assistance in how to interpret that data. So our more recent efforts have been directed toward this and I really think this is where the computer will play its most vital role.